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to say "father," smiled and added "and—both of them." "But you were about to say your mother and—?" "My mother and—and—her husband." The second case is that rare occurrence, auto-hypnotism. One of the students can sit down, lay out a certain course of action, hypnotize himself, performed the predetermined operations, return to his seat and wake up. While in this state, no outside personality has any influence over him. He has used this power several times to induce sleep at night, waking as usual the next morning. On one occasion feeling rather exhausted he dropped into a chair and said he would hypnotize himself, in order to feel well upon awaking. Accordingly he did so, and after about forty-five seconds awoke declaring that his head felt much better, though his body was still tired. It is to be regretted that the observations were conducted for their popular interest more than for their scientific value; it is to be hoped that this case of auto-hypnotism will be more carefully observed and described.

E. W. SCRIPTURE.

IV.—SIGHT.

GREEFF, *Untersuchungen über binokulares Sehen mit Anwendung des Hering'schen Fallversuchs*, Zeitschrift für Psychologie and Physiologie der Sinnesorgane, 1892 III 21.

This is a more careful test of Hering's experiment with the falling balls in order to determine the accuracy of our perception of the third dimension and the conditions upon which it depends. The apparatus used by Hering and the conditions of the experiment were somewhat modified by Dr. Greeff, but only with a view to greater mathematical accuracy in the results, and to a greater variation of the circumstances under which the judgment of observer was to be formed. The distance between the eyes and the point of fixation was made definite and measured. A screen was employed so as to make the angle at which the falling ball could be seen the same for all the experiments. Also a perforated screen was placed above the line of vision with the holes in it at regular distances which were measured. The balls were dropped through these perforations and the judgments of the observer recorded with the known and definite distance of the falling ball from the point of fixation whether before or behind it. The design in shutting off from view a part of the distance of the falling ball and including only that came within the limits of a given angle was to exclude the influence of ocular movements upon the judgments of localization in relation to the point of fixation. The observer looked through a conical shaped roll of paper with the inner surface darkened, and the apex or smaller end farther from the eye in order to prevent the entrance of disturbing rays of light into the eyes. This conical tube was about 30 cm. long, and the wider end about 20 cm. wide. The point of fixation in a box of 60 cm. length and 20 cm. width was situated 95 cm. from the eyes. This distance, however, seemed to vary with the conditions necessary to produce the parallel position of the eyes by means of a prism before one of the eyes. This expedient was resorted to in order to remove the force of the supposition that a convergent position of the eyes had something to do with the judgments of localization. In all his experiments Dr. Greeff found that at all distances the judgment of distance was as correct when the eyes were in a parallel position as when convergent. The observer's confidence and certainty were as great in one case as in the other. The 2 to 3 per cent. of failures he attributes to the fluctuations of attention and the coincidence of winking with the fall of the ball. The most noticeable feature is the marked difference between monocular and binocular vision in regard to the correctness of the judgment of distance. The first set of experiments represents four

different conditions with a common point of fixation 1.12 cm. from the observer. The first 50 trials were with monocular and the second 50 with binocular vision and without the use of prisms. The third set was with the aid of a prism to produce the parallel position of the eyes, and the fourth set of 60 trials was with prisms that produced slightly divergent position of the visual axes. The judgments represent the relative localization of the falling ball compared with the point of fixation. Following are the results:

| | No. of Balls. | Right Judg- ments. | False Judg- ments. |
|---|------------------|--------------------------|--------------------------|
| Monocular vision, | 50 | 26 | 24 |
| Binocular vision, free, | 50 | 49 | 1 |
| Binocular vision, with parallel axes; Prism 7, | 50 | 50 | — |
| Binocular vision, with divergent axis: Prism 8, | 20 | 18 | 2 |
| Prism 10, | 20 | 20 | — |
| Prism 12, | 20 | 17 | 3 |
| Prism 14, | 20 | 8 | 12 |

The prisms were placed before the right eye and were multiplied in order to produce the utmost degree of divergence possible. The results are three-fold. *First*, the increased accuracy of binocular over monocular vision. *Second*, the equal accuracy of all three positions of the eyes in the judgment of relative distance; namely, the convergent, parallel, and divergent positions. *Third*, the coincidence of error with that degree of divergence which overcomes the tendency to fusion. When the same general principles were observed and the point of fixation was made 60 cm., of 200 falls in monocular vision 51 per cent. was false, and 200 in binocular vision only 1.5 per cent., 98.5 per cent. being correct. This set of conditions was assumed as a starting point for increasing the distance of the point of fixation in order to see what the limit of correct localization would be when the balls fell the same distance before or behind the point of fixation. When the last was made 1 m. the percentage of failures was still 1.5 per cent.; at 1½ m. it was only 1 per cent. At 2 m. the failures increased to 3 per cent. and at 3 m. they were 6 per cent. This result suggested two changes in the experiment. First, the enlargement of the angle through which the ball fell; and, second, the increase of the distance from the point of fixation for the falling ball. It was found that with the enlargement of the angle of vision and thus of the visual field under the same conditions as above the failures decreased down to 2.5 per cent. when the distance between the edges of the screen was 20 cm. This was for binocular vision. For monocular vision under these last conditions the errors were 4.3 per cent. But with the fixation point 3 m. distant and starting with 1 cm. distance from that point for the falling ball this distance was increased up to 10 cm. when the percentage of errors had fallen to 2 per cent. from 6 per cent. This relation was more particularly determined by a set of experiments with two different persons and the same general result obtained. The general conclusion reached by Dr. Greeff was that the localization was proportioned in its definiteness and accuracy to the ratio between distance of the fixation point from the eyes and the distance of the falling ball from that point. The matter was then more carefully tested by the study of cases in which one of the eyes was either naturally or artificially affected by influences that diminished the distinctness of the images: naturally by maculae corneae, cataracta incipiens, amblyopia congenita, etc.; artificially by powdered lenses.

The results in localization were much as in the first case. The number of errors was remarkably small, being for 100 trials 2 per cent. when the fixation point was 1 m., 3 per cent. when it was 2 m., 5 per cent. when it was 3 m., 18 per cent. when it was 4 m., and 39 per cent. when it was 5 m., and the left eye representing a distinctness of $\frac{1}{2}$ to $\frac{1}{3}$ for the right eye. With the ratio of $\frac{1}{3}$ for the right and $\frac{1}{6}$ for the left eye, and the distance of the fixation point 1 m. the errors were 3 per cent., and 20 per cent. when the distance of the fixation point was 2 m. The distinctness of vision, therefore, according to Dr. Greeff, has very little to do, within moderate limits, with the perception of relative distances.

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J. H. HYSLOP.

HERING, *Prüfung der sogennannten Farbendreiecke mit Hülfe des Farbensinnes exzentrischer Netzhautstellen*, Archiv. f. d. ges. Physiologie 1890 XLVIII 417.

At the time of the publication of Hess's study of the peripheral color sense Hering based upon it a critique of the Young-Helmholz theory (both papers reviewed in this JOURNAL, III, 203, 204). The present paper is a continuation of that critique with particular reference to the color-triangle of König and incidentally to those of Maxwell and Fick. Hering finds one and all of them and indeed all possible color-triangles made upon the Young-Helmholz theory out of harmony with the facts established by Hess. The discussion is technical and for it the reader is referred to the original. In the latter part of the paper he also shows the irreconcilable opposition between the observed brightness of colors seen with the periphery of the retina and the three-color theory, citing in part the results of a study of that subject, also by Hess, presently to be published. The reply of Fick to his former paper, reviewed in the JOURNAL, III, 574, reached him to late for special rejoinder, but he considers its points answered in the present paper, and counts upon Fick as a convert when he shall have investigated the matter by Hess's method.

E. C. SANFORD.

KLOBUKOW, *Vorlesungsversuch zur Demonstration der Wirkung von Complementärfarben und Farbengemischen beim Zusammenbringen von gelösten Farbstoffen*, Ann. d. Physik u. Chemie 1891 XLIII 438.

In explaining the effects of mixing colors to a large audience it is very desirable to have direct mixtures and not those produced by the color-discs. It is proposed to have colored solutions of the desired shades so prepared that they are not soluble in and cannot take color from one another but have a great difference of specific gravity. Two solutions are shaken together in such quantities that the desired color is produced. The mixture is than allowed to stand a short time, at the end of which the two component colors are found separated one above the other. For example, to show the effects of a mixture of red and green a solution of aldehydegreen in amylalcohol and one of cobalt-salts in water are used. If the proper strengths are employed the mixture is a dirty white. The addition of common salt to the cobalt solution hastens the separation of the two. For mixtures of blue and yellow a solution of phenanthrenchinon or some other derivative of chinon that is insoluble in water but soluble in amylalcohol and an ammoniacal solution of copper in water are to be used. The mixture is a bright green and serves to show that mixtures of pigment colors are different from those of spectral colors. Likewise a solution of chinon in amylalcohol and a combination of the solutions of cobalt and copper in water (as near as possible to the violet of the spectrum) will give a dirty white when mixed in the proper proportions, whereas the corresponding spectral colors are not complementary.

E. W. SCRIPTURE.